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STEEN, Henry, B., III [/]; (). MARTIN, Cecil, D., Jr. [/]; (). CORLEW, Edward, A. [/]; (). STEEN, Henry, B., III [/]; (). MARTIN, Cecil, D., Jr. [/]; (). CORLEW, Edward, A. [/]; (). PARKER, Sheldon, H. ; ().

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(54) Title: REMOTE DATA ACCESS AND SYSTEM CONTROL

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(57) Abstract

A system for enabling a user to monitor and control a remote equipment site over the Internet. All user access is through modules, or servlets (114), located on a central server (100). Servlets (114) prevent the central server software from being directly accessed. The system provides several levels of access, through the use of access codes (110), to prevent unauthorized users from accessing information. The central server (100) communicates with remote units (122) that are proximate the equipment (124) and that have communication capabilities (120). The central server (100) can notify the user through the use of a pager or other notification means. The central server (100) automatically contacts each of the remote units for each user on a predetermined schedule and updates data (112) from each remote unit. The central server software also enables the user of the remote unit to request a data update in addition to the predetermined scheduled transmissions.

(57) Abrégé

La présente invention concerne un système permettant à un utilisateur de surveiller et contrôler un site d'équipement distant sur l'Internet. Tout accès par les utilisateurs s'effectue à travers des modules, ou mini-applications (114) situés sur le serveur central (100). Des mini-applications (114) empêchent l'accès direct au logiciel du serveur central. Le système prévoit plusieurs niveaux d'accès, par l'utilisation de codes d'accès (110), pour interdire des utilisateurs non autorisés d'accéder aux données. Le serveur central (100) communique avec des unités distantes (122) qui se trouvent à proximité de l'équipement (124) et qui possèdent des capacités de communication (120). Le serveur central peut notifier l'utilisateur en utilisant une unité de mémoire à accès direct ou tout autre moyen de notification. Le serveur central (100) contacte automatiquement chacune des unités distantes pour chaque utilisateur selon programme prédéterminé et effectue une mise à jour des données (112) provenant de chaque unité distante. Le logiciel du serveur central permet également à l'utilisateur de l'unité distante de faire une requête de mise à jour de données en sus des transmissions programmées prédéterminées.

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(71)(72) Applicants and Inventors: STEEN, Henry, B., III [US/US]; 1506 Greenmeadow Court, Bowling Green, KY 42014 (US). MARTIN, Cecil, D., Jr. [US/US]; 608 Griffith Avenue, Owensboro, KY 42301 (US). CORLEW, Edward, A. [US/US]; 100 Green Meadows Drive, Hendersonville, TN 37075 (US).

(74) Agent: PARKER, Sheldon, H.; Parker & DeStefano, P.C., Suite 300, 300 Preston Avenue, Charlottesville, VA 22902 (US).

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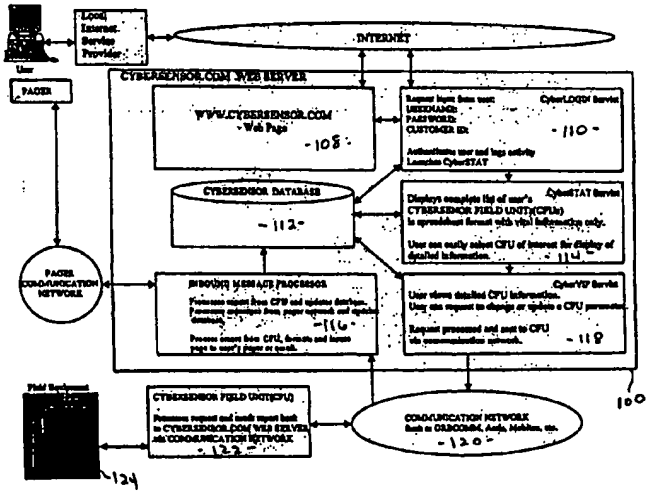

(57) Abstract

A system for enabling a user to monitor and control a remote equipment site over the Internet. All user access is through modules, or servlets (114), located on a central server (100). Servlets (114) prevent the central server software from being directly accessed. The system provides several levels of access, through the use of access codes (110), to prevent unauthorized users from accessing information. The central server (100) communicates with remote units (122) that are proximate the equipment (124) and that have communication capabilities (120). The central server (100) can notify the user through the use of a pager or other notification means. The central server (100) automatically contacts each of the remote units for each user on a predetermined schedule and updates data (112) from each remote unit. The central server software also enables the user of the remote unit to request a data update in addition to the predetermined scheduled transmissions.

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Description

REMOTE DATA ACCESS AND SYSTEM CONTROL

Cross-reference to Related Patent Applications

The present application claims the benefits under 35 U.S.C. 110(e) of provisional patent application serial number 60/128,513 filed April 9, 1999 and 60/129,708 filed April 16, 1999. This application incorporates by reference, as though recited in full, the disclosure of the foregoing co-pending patent applications.

Field of the Invention

The invention relates to the remote access of data and system control, and more particularly, to a web- based and satellite interactive system for remote accesses of data.

Background of the Invention

Data access and remote control of process equipment have been primary areas of activity for computer design engineers and programmers. Many systems are custom designed to meet the customer's particular needs, however this customization is expensive, making it out of financial reach for small companies. In systems that are not custom designed, existing remote telemetry and control solutions require an excessive hardware and software investment.

A serious, and persistent problem with the remote downloading of data files or the remote control of process equipment is the ability of unauthorized third parties to gain access to the data or equipment. Encryption techniques have been employed to safe guard data from unauthorized access, however this is not a total solution. Encryption has limited value in those circumstances where there is a large number of authorized parties and the encryption cannot be readily customized for each user.

SUMMARY OF THE INVENTION

The disclosed system enables a user to monitor and control a remote equipment

site from any remote location. Preferable this is accomplished through the use of Internet access to a website at the system provider's server, although other methods can be used. The disclosed monitoring system maintains the operating software on the primary site, that is, on the system provider's server and data is available to customers only through the provider's software. All data access is through the use of modules, or servlets, preventing the provider's operating software from being directly accessed, thereby eliminating modification or alteration by any user, authorized or unauthorized. For simplicity, in this document, any reference to satellite communication technology shall be deemed to include satellite, cellular, R.F, terrestrial or non-terrestrial communication networks.

To monitor and control the remote equipment, the system uses a central server containing provider software database which has storage and communication capabilities to store, sort and display data and is accessible by a user from a remote location. Preferably the information is accessed over the Internet, through use of a computer, enabling the user to interact with the providers web site. The software uses at least one servlet as an interface between the users and the provider software, to prevent direct user access to the software. The software also monitors the user's transmission time and type in order to charge the user. The system communicates with remote units that are proximate the remote equipment and have communication capabilities to enable the remote units to have two way communication with the provider software. The remote units have monitoring devices, such as sensors, that communicate with the remote equipment, receiving status data from the equipment. Each remote unit has the capability to receive data from multiple pieces of equipment

for forwarding to the provider software. The remote unit transmits the data from the monitoring devices to the provider software for storage and user access through the servlet(s). Each of the remote units is programmed with definable maximums and minimums for data received from said monitoring means. These maximums and minimums are initially defined, and can be redefined subsequently, by the user. If the values for a piece of equipment fall out of these ranges, the system provider is notified by the remote unit. The system provider can then notify the user through the use of a pager, cell phone, or other notification means.

The system preferably provides several levels of access, through the use of access codes, to prevent unauthorized users from accessing information. In the preferred embodiment these are read; read/write and administrative level, with each of level respectively increasing access to the data.

In the preferred embodiment, the system is accessed through a web site having multiple display pages that display the data transmitted from the remote units. The display pages are accessed and displayed through use of the servlet(s). The displayed format and data are defined by the user and can include a summary page listing the status data for all remote units; a detailed data page listing predetermined detailed data for one remote unit; and an error data page listing predetermined error data for one remote unit. The user configures the system through use of a data configuration page that enables a user to define the parameters for each monitoring device and a data setup page that enables a user to customize data and select from predefine parameters for each monitoring device

The data can be transferred either by the remote unit automatically contacting the provider software, based upon a user define schedule, or the provider software

~~can automatically~~ contacts each of the remote units for each user. The provider software can contact the remote unit on a predetermined schedule and/or upon user request. The system provides the user with the ability to redefined the schedule. Preferably the updates are automatically received from the remote units to minimize satellite time.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a flow chart of the system information accessing process;

FIGURE 2 is a flow chart of the system hardware and data flow using LEO satellite;

FIGURE 3 is a flow chart of the system hardware and data flow; using generic satellite and various terrestrial network systems.

FIGURE 4 is an example of an initial web page screen;

FIGURE 5 is an example of a login screen;

FIGURE 6 is an example of a CyberSTAT summary screen;

FIGURE 7 is an example of a portion of a virtual instrument panel;

FIGURE 8 is another example of a virtual instrument panel;

FIGURE 9 is an example screen of the error reporting control panel;

FIGURE 10 is one example of the a graph produced in response to the Stats Graph of Figure 6;

FIGURE 11 is an alternate graph produced in response to the Stats Graph of Figure 6;

FIGURE 12 is an example of a unit configuration screen; and

FIGURE 13 is a example of an account setup screen.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

AND BEST MODES OF THE INVENTION

The disclosed system enables a user to monitor and control a remote equipment site from any remote location. Preferably this is accomplished through the use of Internet access to a website at the system provider's server, although other methods can be used. The disclosed monitoring system maintains the operating software on the system provider's server and data is available to customers only through the provider's software. All data access is through the use of modules, or servlets, preventing the provider's operating software from being directly accessed, thereby eliminating modification or alteration by any user, authorized or unauthorized. For simplicity, in this document, any reference to satellite communication technology shall be deemed to include satellite, cellular, R.F, terrestrial or non-terrestrial communication networks.

The use of the term servlet or module herein is not indicative of any specific operating program or programming language. Although many servlets are written in Java, any language that interacts with the server database platform can be used. The novelty of the system lies in the removal of the operating software from the user and placing all operation in the provider's system. The servlets merely provide independent action modules that serve to interface between the user and the provider's database, providing additional security and ease of use.

The servlets used in the disclosed system are written to be very generic, thereby meeting most of the customer's needs. Illustrations of several servlets and how they can be used to either gather data or launch systems are as follows:

1. Running Continuously or Timer Launched:

ProcessMAIL: processes incoming messages from the field unit and updates database.

2. Running Continuously or Timer Launched:

SendPage: sends a alarm or error page to a user's pager network based upon status in database.

3. **CyberLOGIN** : Authenticates the user

Launches:

CyberSTAT : provides summary information about the user's field units

Launches:

CyberGRAPH: displays graph of histogram data associated sensor values or statistical information

CyberVIP: displays values of sensor inputs and all parameters associated with a particular field unit

Launches:

CyberSEND: sends request to update a field parameter or request for up-to-date sensor data, etc.

CyberLOG: sends receive and send log files to the user's email address

RESET: sends a special software reset to the field unit

STATUS: sends a request for system status to the field unit

ErrorStatus: processes data relating to error reporting control panel configuration

It should be noted that the foregoing servlets are for example only and other servlets to meet other criteria will be obvious to those skilled in the art. The user

accesses the provider's web site through any web browser, as for example Netscape® and Internet Explorer®. Since the web site houses the servlets that function as the software for the system, the user's computer does not require software installation. In many applications, the servlets function as the software that provides the user interface to the database. In other cases, the software can be written in any appropriate language, for example C++, PERL or UNIX script, all of which can access the database if necessary. In addition to providing easy updating, the maintaining the operating software on the system provider's server increases security since all direct access with the actual database is internal. The servlets serve as a buffer between the database and the user.

The provider's system also enables application to application (machine to machine) database connectivity in several forms such as, but not limited to: ODBC, Streams and XML. This feature increases overall functionality and marketability. The field unit data is processed by the system provider's software, which in turn, can updates the user's database. This system not only prevents inadvertent altering of the data by users, but provides an added measure of security from Internet associated break in.

Software on the provider's system enables the user to enter valid requests to change field parameters and/or configuration changes. These requests are processed accordingly and stored in the provider's database. Upgrades or modifications to the software are invisible to the user, since all changes to the operating software and servlets are made at the primary site.

All values received through the servlets and other modes of communication are stored in the database including configuration parameters In addition to storing data, the server database software preferably includes the following

functions:

1. Provides a user interface to the data without local software;
2. Correlates internal and external data;
3. Provides graphs and histograms of internal and/or external data;
4. Provides an alarm or an error signal to the user's pager network for instant alert to alarm or error condition;
5. Provides a central data access point for multiple, simultaneous users.

The platform and programming of the database will be evident to those skilled in the programming arts.

In instances where the web site is providing control and data readings of equipment and/or systems located at user remote sites, the same security holds true. Data received from the remote site is fed directly into the disclosed system, thereby placing the provider's database between the remote site and the user. Therefore, any modification of process equipment must be accomplished either directly at the physical site or through the system provider's server. Thus the servlets function as a firewall between the user, authorized or unauthorized, and the data and the remote equipment and/or systems. All changes can be stored in an event log both on the server and in the remote field equipment. This list can be made accessible from the user administrative account. Excessive changes can cause an alert message to be sent to the system administrator or the field unit's administrative contact person via email or pager. Also, procedures can be instituted that allow any changes made to the field unit's parameters locally, in the field, to be automatically uploaded to the server when the Internet becomes available to the field technician's computer. Remote users do not have to install any software on their computer except for a standard web browser.

In Figure 1, the flow of information from the user, through the Cybersensor system to the field and back to the user is illustrated. For description herein, the solid boxes drawn in Figure 1 contain finite and quantifiable hardware located at a particular location. The solid ellipses, for description purposes, are to be considered network "clouds". For example, the box depicting the Cybersensor Field Unit (CFU) 122 can consist of a satellite subscriber communicator and/or application processor and associated Cybersensor power/interface modules and sensors. The power/interface modules and sensors can be either located at a fixed site or mounted to a mobile vehicle. For example, the power/interface module can consist of a solid-state relay and contactor used to start and stop a large motor. An example of a sensor could be a tank level monitor or flow detector that is used for telemetry and/or to provide feedback to the local control system. Conversely, the ellipse depicting the communications network 120 includes hardware and software owned and operated by the communication network only. From the perspective of the disclosed system, it is only relevant for the input and output capabilities and will vary dependent upon the current applicable technology. In the preferred embodiments, the CFU 122 has the ability to receive from the Cybersensor server 100 as well as transmit. The critical feature is that the CFU 122 has programming capabilities that enable the CFU 122 to send data to the Cybersensor server 100 based upon a predetermined schedule. This schedule is defined, and can be redefined at any time, by the user and can be based upon a specific time, or times, of day or every preset number of hours. The configuration screen 212 of Figure 12 enables the user to redefine the parameters stored in the CFU 122 from the user's computer. This enables the user to customize the delivery of data based upon their specific needs and type of application. Alternatively, the transmission schedule can be

altered on site. The method of transferring data saves on the cost of satellite time; thus allowing the monthly provider's fees to be minimized.

In Figure 1, the User has access to a personal computing device 102 and a pager 104. The personal computing device 102 is shown to connect to the Internet via a local Internet service provider. It should be noted that the Internet provider can be accessed via conventional phone lines or any available means currently in use, including wireless technology. Additionally, the data can be accessed through use of a palm pilot, telephone, or other communication device, having web connection capabilities. For example, a palm pilot can contain a script that enables either viewing in the same manner as with a computer or, alternative, only displaying values programmed into the script. In this way, a user can rapidly access only critical values, completing a full review of the remote units from a computer. Updates can be obtained by phone by dialing an access number and user codes. Once the user is verified, the provider software can "read" the values over the phone. A menu can be used to select the type of equipment, remote unit location, etc.

Once the user establishes a link to the Internet, he or she has access to the CyberLOGIN module 110 (Figure 5) via the appropriate Internet address 108 (Figure 4). The CyberLOGIN module 110 establishes a secure connection, using any current methods, such as Secure Socket Layer, SSL or Virtual Private Network, VPN, to the user's web browser and requires that the user authenticate via username, password and customer ID.

CyberLOGIN 110 authenticates the user by comparing login information to the information stored within the Cybersensor database 112. If the user is authenticated then the CyberLOGIN 110 servlet launches the CyberSTAT module 114 (Figure 6).

Failed attempts are processed and logged to the system log and the system administrator is alerted when the unsuccessful login attempts exceed a preset number. If automatic rejection is employed by the system administrator, after a preset number of failed attempt, the user will not be able to login even if the proper username, password and customer id is entered. The CyberSTAT module 114 accesses the Cybersensor database 112 and provides the user with a complete list of Cybersensor field units (CFUs)). The summary information presented from the CyberSTAT module 114 reports error and/or statistical information related to each of the "User's" CFUs as listed in the unit column 62. This information is displayed in any number of formats, depending upon the user's requirements. The CyberSTAT module illustrated in Figure 6 is a spreadsheet forma, however any manner of graphical layout can be used, as well as 3D, virtual reality, holographic, pictorial or any other currently appropriate method that meets the requirements determined by the user.

Detailed information related to a particular CFU and its associated field equipment can be accessed by clicking on the name field, or any object relating to that particular CFU located on the CyberSTAT page, thus launching the CyberVIP servlet 118. From the administrative user account, or unit configuration form, Figures 12 and 13, the CyberVIP servlet 118 (Figure 6) can be configured to show or hide parameters and information relating to the CFU or connected Field Equipment. In addition to various display features, such as time zone, etc. the administrative control panel allows irrelevant information to be filtered and hence "hidden" from the Read/Write and Read-Only Accounts. The administrative control panel is used to configure all parameters associated with the user account, for example it can be used to select the type of

communication network to be used. If coverage varies or the field unit is mobile, the order of network type and retry count can be set to accommodate the user. Normally, the user will access this information using the read-only or read-write account, as described further herein. If the user requests information from the CFU, the CyberVIP module 118 processes, formats and submits the information request to the appropriate communications network. This request can either be sent directly to the communication network 120 or passed to the Cybersensor Message Management Processor (CMMP) as shown in Figure 3. The Cybersensor Message Management Processor (CMMP) can interactively manage messages sent to any communication Gateway. The most functionality is realized when the CMMP is connected to a manageable Gateway with an interactively managed message stack. The preferred machine-to-machine protocol used to communicate with the communication network Gateway is XML.

In this embodiment, inbound messages from the communication network 120 are processed by the inbound message processor 116. In alternate embodiments, as illustrated in Figure 3, both the inbound and the outbound messages are handled by the CMMP. In any system used, the processor must have the ability to unwrap and decode all message formats from any CFU 122 via any communications network 120 and update the database 112 appropriately. Also, the inbound message processor 116 can be configured to send and receive status, error or other kinds of messages to and from the user's pager 104. The format and amount of information of the inbound and outbound messages can vary depending upon which network is being used. The field equipment 124 can

have various hardware configurations that feed into the CFU 122; however, the messaging protocol must be specifically selected to insure compatible with the server's 112 protocol. These standard protocols are used by the field units and the central server to insure that all messages are encoded/decoded properly. The type of protocol or information format, however, does not limit the type of sensors, input/outputs or other information transmitted. In fact, as long as the equipment protocol is known, the provider's server 100 can be configured to communicate with any remotely located equipment, including, but not limited to, other computers or a network of computers.

Figures 2 and 3 illustrate two alternative internal methods of handling the data transfer. In Figure 2 the Orbcomm N.C.C. Isocor Server 510 is used as a direct gateway for the Cybersensor server 500. The data received from the Orbcomm server 510 is relayed to the Cybersensor IMAP server 502 and then to the CRON timed maintenance 504. The CRON 504 is a script application that runs on a timed basis, managing all incoming messages. Depending upon the program scheduling, the remote unit will periodically transmit data to the server 550. The CRON 504 takes the incoming messages and updates the database 506. The CRON 504 further sends messages to the user's pager service, or other notification device, to notify the user of a critical error. The Internet server 508 handles the outgoing messages, as received from the user. Thus if a user requests an update, the request is transmitted from the Internet server 508 to the Orbcomm server 510 to the remote unit. The returning data is sent from the remote unit to the IMAP server 502 to the CRON 504 where it is placed into the database 506. The updated data is then accessible from the database

506 by the Internet server 508 upon submission of a request by the user.

In Figure 3, any IP Gateway 552 is used to connect the Cybersensor server 550 to various available networks 554. In this embodiment, the CRON 504 of Figure 2 is replaced by the Message Management Process 556 to handle the incoming data from the remote units. The outgoing requests made by the user are also sent to the message management process 556, providing additional tracking advantages. This system further provides the advantage that any gateway can be used, rather than an Orbcomm specific. In this embodiment, the message management processor runs continuously and is therefore able to handle messaging tasks immediately. This enables the provider software to group and time transmissions in order to optimize satellite time. As stated theretofore, the system uses several modules to provide processing and storage of data as well as efficient access to the connected remote sites. It should be noted that the modules disclosed herein are example core modules and additional modules can be used for both internal data handling and user storage and retrieval.

Module 1, known as CyberLogin 110, is the first point of entry to the system, as illustrated in Figure 5. This module is responsible for establishing a secure (encrypted/decrypted) link to the user's web browser and authenticating the user. Alternatively, an entry web site 108, an example of which is illustrated in Figure 4, can be established so that it enables the user to access various other information from the provider, as well as take the user to the login screen 110. Although username 50 and password 52 security entries are common, the disclosed system preferably also requires a Customer ID 54 entry in the login

screen 110. The three entries are preferred due to the separate levels of entry allotted within each company. Alternate methods of identifying the person entering the system, such as computerized ID chips, fingerprint recognition, etc. can also be used, dependent upon the current technology and systems available to the end user.

Three levels of data access; Administrative, Read/Write, and Read-Only are preferred and are generally controlled by the CyberLogin module 1. The access level is related to the username and password in the master system database. If there is a cost associated with using the communication link network, customers must be charged for their use of the system. In the disclosed examples, the system provider provides user access tokens in order for the customer and provider to monitor and record the numbers of data transfers to and from the remote field units. Each time a customer requests an update from the remote field unit using the virtual instrument panel, as illustrated in Figure 6, they use an access token and when the new data arrives from the remote field unit, the system automatically deducts another token. A request to update a field or data parameter is accomplished clicking on the "UPDATE" button in CyberVIP or any other software module that allows the parameters to be updated. The "cost" can also be determined by the size or type of transaction message, time of request, frequencies of requests within a time period, etc. For example, a field unit report without a request from the user is a different charge than when the report is requested by the user, thereby creating a two-way transmission. The access tokens are tracked by the module and are displayed by a data access counter 80 of Figure 7. In the disclosed illustrations the access counter 80 is displayed on the CyberVIP screen 118, however the current status of the tokens can be displayed on any page applicable.

depending upon end use and/or user preference. Although the monitoring is handled by a module, or servlet, the usage data is stored within the customer's database. In order to provide the customers with additional tracking capabilities, specific access data can be stored for administrative reports, making available such items as the number of time a specific person requested information, the expense of automatic updates vs. manual updates, etc. Customers can be limited to the number of access tokens to prevent them from running up a communication link bill. In some instances, where the customer does not have any limits, the token count displayed on the access counter 80 can be the number of tokens used to enable the customer to trace the number of accesses. The following is an example of access privileges as well as how the access tokens are allotted to a customer, based upon data access level. It should be noted that this is an example only and in no way limits the system to the specific access abilities, reports available or the number of tokens. The administrative user "sees" all of the features of the Read/Write and Read-Only users with the addition of the administrative control panel (ACP) 212 as illustrated in Figure 12. The ACP 212 allows the administrator to manipulate many of the system configuration parameters, change scheduled report times, rename and add remote units, define what constitutes an error message, etc. The administrative user has access to the ACP from CyberLOGIN, CyberVIP and CyberSTAT.

- Administrative Access provides read/write privileges, giving them the ability to customize the parameters displayed on the virtual instrument panel. This level can be assigned, for example, 100 access tokens with the ability to purchase additional tokens automatically or manually.

- Read/Write Access provides the ability to read current parameter values and change the parameter values. This differs from the Administrative level in that although parameter values can be adjusted, they are only adjustable within the customized parameters set in the Administrative Access. Further, the read/write access level cannot determine the parameters to be monitored. This level can be assigned, for example, 100 access tokens with or without the ability to purchase additional tokens.

- Read-Only Access limits the accessibility to only reading the current values of the parameters. The read-only access is assigned 95 access tokens with or without the option of additional purchase.

The entry of the Username 50 causes module 1 to contact the database 112 to verify the existence of that name. The password 52 is similarly verified with the database. If more than one occurrence of the username and password exists in the master system database then the comparison of the Customer ID 54 is compared. If there is only one occurrence of the username and password in the database the Customer id 54 can be automatically obtained from the master system database or the system can be configured to force the user to enter a valid Customer ID. Once verification has been determined that the user is authorized, CyberSTAT is launched to allow the user to view the last reported status and statistics from database for all accounts, or field units, associated with the Customer ID.

Module 2, illustrated in Figure 6, is a module program, known as CyberSTAT, which provides hotlink access to all of the user's remote field units, enabling CyberSTAT to be used as a very effective resource management tool. It accesses the database automatically and provides the user with error and statistical information on a

line per unit basis. At a glance, the user can instantly identify a field unit that needs attention and navigate to it via a hotlink or know that all systems are working as programmed. Preferably the fields are color coded to allow for immediate recognition.

The user, with administrative level access, through the configuration editor, can add other features to CyberSTAT. For example from CyberSTAT, a person in the oil and gas industry can configure CyberSTAT to report the amount of oil or gas production from each well site. CyberSTAT also provides a "hot-link" access to the CyberVIP page that would then contain more detailed information related to each well site.

As illustrated in the screen 114 of Figure 6, the CyberSTAT module 2 displays the unit name 62, a new report status 64, a last updated status 66, an error status 68 and a statistical graph 70 for each of the accounts, or field units, associated with the user's account. These are only example displays and other fields, specific to the industry, can be displayed. The module 2 illustrated in this Figure presents the information in a spreadsheet type format, although other formats can be used. The configuration editor can be used to select the presentation format or style. If the spreadsheet presentation style is used, the user can scroll up and down to access the entire list of field units. CyberSTAT automatically reads the latest information from the customer's master database and presents the information to the user. The time periods between system's updating can vary dependent upon the customer's accessing patterns and can be changed by the customer to accommodate a change in access patterns. For example, customers with constant on-line access can have the module 2 page constantly displayed on a dedicated screen. In these situations, the module 2 would search for updated material periodically, as programmed by the user. For

customers who go on and off line, module 2 would present the new data upon verification of the customer ID numbers after the user logs into the system. These are only two examples of the versatility options that can be included in the program.

In some cases, the information will be color coded to indicate, at a glance, to the user that a field unit is in a particular state or if a sensor has exceeded a preset limit. For example, in the error status column 60, a red "error" box 60A can be displayed if the field unit has reported an error condition. In the absence of errors from the field unit, a green "clear" box 60B is displayed in the error status column. An error condition can be acknowledged by the user from CyberVIP by entering into the error status screen of Figure 9. Therefore, the next time CyberSTAT is launched the "error" message will be displayed as an "acknowledged" box 60C. In situations where the module 2 is constantly displayed, the change from "error" to "acknowledged" would be automatically changed when the database receives, processes the message and returns the acknowledged message. In the case where multiple users are monitoring the same CyberSTAT page, the acknowledge feature indicates to the users that someone has acknowledged the error. To view detailing information related to the error, the user can click on any of the boxes related to the field unit and Module 3 (CyberVIP), illustrated in Figures 7, 8 and 9, is launched. The user configuration module enables the user to change the text associated with the error condition. This allows other users of the system to better understand the error condition. In the module the user can view detailed error information that relates to the particular remote field unit. A field unit can be configured to monitor/control several individual instruments or devices. From CyberVIP, a user with read/write privileges can selectively enable/disable pages associated with alarm events/conditions from each individual device attached. For

example, if a device A is known to be malfunctioning, the pager reporting can be disabled on device A only leaving the other devices able to report alarm conditions.

The last received report column 66 of Module 2 displays the last time that the remote field unit sent data to the service provider's server. The status column 64 informs the user whether or not there are new reports since the last date and time indicated in the last received report column 66. The "New Reports" indication tells the user which unit has sent new reports that have not yet been viewed by a user. From this screen, the user can click on the name of the specific unit to be viewed, or enter through other means, module 3, the CyberVIP 118, for more detailed information. The information provided in the summary screen of Figure 6 serves as an example and other pertinent summary information can be included.

The stats graphs column 70 provides the user with the ability to view and print graphical representation of the application functionality over a preprogrammed period of time. Two examples of graphs are illustrated in Figures 10 and 11, although other types of graphs, maps, etc. can also be incorporated, depending upon user preference.

The link provided in Module 2 will take the user to Module 3, illustrated in Figures 7 - 9, for the corresponding field unit. The CyberVIP screen 118 is field unit specific and displays complete and detailed information related to a particular unit. This screen displays all relevant information related to a field unit, including sensor values, such as but not limited to pressure, temperature, flow rate, liquid level, etc. Each of the parameters for the particular unit can be updated from this screen. An update can consist of an immediate request for up-to-date data or status information; or it can be a request to change or view the value of a field parameter. The system can further display geographical images or maps and position information sent from the field unit's

Global Positioning System (GPS) receiver or calculated from Doppler positioning techniques. In addition to position, the status and/or value of any sensor or cargo can be also displayed. In the illustrated screen of Figure 9, information such as the report and pager status is included as well as an overall "system" OK. These screens are only examples of the type of system checks and parameters that can be included and are, in no way intended to limit the scope of the invention.

The field units 122 are fully programmable and can be configured to suit a variety of autonomous and semi-autonomous controller applications applicable to the specific field equipment 124. Each CFU can control and monitor multiple devices or equipment, such as, but not limited to pumps, valves, etc. The CFU's can be configured to operate in several network configurations, i.e. to communicate directly to the satellite or terrestrial network, or communicate in a local area network (LAN) configuration with one of the CFU's acting as the wide-area-network (WAN) gateway. In addition to multiple network communication functionality, each unit has the ability to monitor sensors and control local equipment. In addition to automatically transmitting scheduled data updates, all field units 122 have the capability to automatically generate a report by exception (RBE). The RBE is generated from several kinds of conditions. For example, if a minimum and maximum limit for a particular piece of field equipment 124, has been established in the field unit 122 for a particular input, and the limits on this input are exceeded, an RBE will be sent to the Cybersensor database. If configured for paging, the server can send a text page to the user describing the fault condition. If the paging service, or other method of notification, is bi-directional, the acknowledgment of the error condition can be sent to the CFU. The server will post the status of the error to the database and can be viewed

from module 2 and/or module 3.

Module 3, or CyberVIP, as illustrated in Figures 7 - 9, generates the detailed report data. Module 3 is a separate module, or servlet, program that is executed on the web server, interacting with the database and sharing information with Module 2, CyberSTAT. CyberVIP acts as a virtual instrument panel for each field unit, displaying a list of all programmable field unit parameters, analog inputs, digital inputs, digital outputs, detailed error reports, status information and various field unit specific data such as oil production or pump activations. CyberVIP can be also be used to easily send or update information contained in field unit. To update information in the field unit, the user can type a new value in the box titled "New Value" and press "Update". The new value is then sent to the field unit and confirmation of the change is returned to the server. When the confirmation report is received from the field unit, the server will display the current "Value" which should reflect the submitted "New Value" that was sent to and received from the field unit 122. If the "value" is unacceptable to the user, a "New Value" can be resent to the field unit. For example, if the minimum operating temperature of the field unit is determined to be unsafe, the minimum temperature parameter can be set to a safe level ("New Value"). When the unit's temperature exceeds the minimum safe level, the unit will automatically power down. The provider's system preferable includes a set of commands that can be sent from the server to the CFU to shut-down a piece of equipment for a predetermined period or permanently if desired. This provides a safety feature, as well as economic advantage to the user.

Unit conversions for each value are preferably automatically calculated by the

server prior to the data being displayed by CyberSTAT module 2 or CyberVIP module 3. For example, if the user is monitoring a pressure transducer, the units are displayed in PSI. The conversions are based on the multiplication factor and offset values that are stored in the preprogrammed plug-n-play sensor list on the database. The type of unit, i.e. PSI, hours, etc., is automatically determined by the type of application entered from the pull down list 222 in Figure 13. An override is provided in the event the user wishes to change the unit. The conversion factors can be loaded into the database via an automatic sensor identification process, manual section of the sensor from an approved list of sensors, or manually loaded into the database. This capability adds value, above and beyond any existing technology, by allowing all user's to benefit from the expansion of central server's plug-n-play sensor list. For example, if a new sensor is added to the plug-n-play list, the user can simply plug the sensor into the remote field unit and remotely select the corresponding sensor from the plug-n-play sensor list in the user configuration module. A graphical representation of the field unit's inputs/outputs can be displayed during the sensor selection process. This can assist the user in relating the physical connector position with the kind of sensor that is connected to it. If an intelligent sensor is used the system will automatically report the kind of sensor that is installed with no input/setup is required from the user other than plugging in the sensor itself.

It is through this module 3 that the access levels are applicable. The read/write access level is, within this module 3, able to request updates on any parameter or change parameter values. If the user has read-only access, they can only request

updates and view information. In addition to the read/write access privileges, a user with administrative level access can also launch the configuration editor 212 of Figure 12. The configuration editor 212 allows the user to completely customize CyberSTAT and CyberVIP by enabling the selection of sensor types, custom labeling and titles and formatting the way the data is presented as shown in the Figures and charts illustrated herein. The administrator can either run the configuration wizard from a local client software package such as Microsoft Access or it can be executed in the form of a servlet requiring no software other than the web browser on the user's computer. The administrative user can select from a multitude of capabilities, selecting or deselecting various parameters needed for telemetry and/or control of the field unit. Many generic features can be combined to accomplish a variety of configurations. If the generic features are not sufficient, the field unit can be custom programmed and the web configuration tailored to fit most any application. For example, if the administrative user only wanted users to view the analog inputs on a field unit, all other available parameters could be hidden from view in the configuration editor. This is done to make the system as simple to use as possible. Once configured, the Administrative, Read/Write and Read-Only users will be able to view the same information. The administrative user can also configure the units, such as PSI, that are to be displayed for each parameter by choosing a sensor from the approved plug-n-play sensor list and selecting the proper units to be displayed. Once a sensor is chosen, the appropriate unit conversions are automatically calculated and displayed as configured by the user via CyberVIP.

A time/date stamp is associated with each parameter to notify the user when the last time a specific parameter was updated. The parameter time/date stamp 78 can be

different than the last updated field 66 of module 2, since the last updated field 66 reflects the time/date of any update rather than any specific parameter update. Due to the costs associated with the satellite time, it is preferable that each parameter be updated individually either upon request or on a preprogrammed time basis. If enabled, the automatic report interval for a parameter can be programmed from CyberVIP. The remote field unit will generate an automatic report at a given maximum time interval or at a given time of day. This report interval can be locked or unlocked by the Administrative user from the configuration editor. The variable report interval helps to eliminate unnecessary network traffic or over reporting or under reporting.

The link between the web site and the remote equipment is most advantageously through a satellite link. In the optimum configuration, a centralized remote computer is connected via wireless technology to the satellite system provider's server. The satellite network server is connected to a central database/web server that distributes information via the Internet to the end user or end-user's local server. It should be noted that once a transaction or update has been requested by the user, the server takes over the responsibility of making sure that transaction takes place. Once submitted, the user has the option to go offline or stay online as desired. If the system is unable to verify communication with the satellite, the operating software is programmed to repeat the communication process until the transmission is acknowledged. In instances where the satellite has responded to a send query that the system should wait until a specific time for transmission, the system will commence sending at the designated time. At that time, if a transmission is not completed, the system will continue to send until the transmission is acknowledged. For optimum power conservation, the remote system can be programmed to cycle power. In this

configuration, the remote system can be programmed to power-up the communication receiver at a predetermined time of day. In this mode, the server can be programmed to attempt communication with the remote system during the time of day that it's receiver is activated.

The satellite transmits each request from the web site to each corresponding remote site or centralized remote computer. The remote site computer serves to process the requests and to control or operate the remote site. In order to reduce cost, it may be preferable that the remote units be connected to one another in a local area network configuration; however, in situations where this is not possible the satellite will communicate with each individual or groups of remote computers. For ease of explanation, reference will be made to each site having a separate CFU, however, as stated, this should not limit the scope of the application.

The remote site computer (CFU) accepts the satellite-transmitted request and processes the request. The request can be to update all or selected parameters, in a standard preprogrammed report format, as for example, all or part of the data contained in the CyberVIP Module 3 of Figure 7. The request can also, for example, instruct the computer to commence or terminate a process cycle, turn on or off equipment, or request position, sensor values or general status information. Position reports resulting from a position request can be derived from internal GPS or Doppler position technology or external GPS or other position detection methods. The remote computer complies with the request and transmits the updated data or response to other request(s). Economic efficiency can be achieved on the remote units by using an integrated application processor that resides on the same printed circuit board as the

communication processor. The receiver/transmitter, or transceiver, can be a radio frequency transmitter of the type sold by Stellar Satellite Communications, Ltd, of Virginia. The radio frequency satellite radio has the advantage over microwave transmitters of being omni-directional and thus not requiring a parabolic dish. Once the satellite network receives the transmission, a transmission-received signal is sent to the remote computer to verify that the transmission was successful. If the remote computer does not receive the transmission-received signal in a preprogrammed period of time, the remote computer contacts the satellite network and retransmits the response. This procedure is repeated until the satellite acknowledges and accepts the transmission. This request for verification is preferable whether the original transmission is generated at the provider's server or the CFU.

The communication between the CFU and satellite can include any number of instructions programmed into the remote computer, for example the user can define that the data be transmitted after a specified time delay or during a specified time period. This functional capability serves to optimize the utilization of the satellite and can reduce power needed by the remote field unit by spreading activities over an extended time period or deferring transmission to periods of low demand for satellite time.

The operating software is written to produce a generic virtual instrument panel. By generic, it is meant that the virtual instrument panel is not application specific but rather can be adapted for use by any system. As for example, using an application specific template, an environmental monitoring company using the disclosed system would incorporate different parameters into their virtual instrument panel than an oil producing company. The data, labels and titles would be different but the program of

the virtual instrument panel can be the same. This kind of versatile programming of the virtual instrument panel enables the applications to be unlimited and development time to be minimal. The administrative user can either manually set-up the virtual instrument panel or select from a variety of default industry specific virtual instrument panel templates. Even though the servlets are not user programmable, they are completely configurable. The way that the servlets present information to the user is customizable via the configuration editor. For example, if a customer wants to monitor fluid level in a tank from anywhere in the world, the remote access system provides the user interface that will enable the appropriate sensors at the remote location to be monitored to accomplish this task. Once the equipment is installed in the field, the customer will have access to such information, as for example, the level of fluid in a fuel tank, through the virtual instrument panel module 3. The titles displayed will reflect the actual name of the tank or contents and the level units can be displayed in feet or meters, etc.

As well as accommodating a variety of users, the disclosed system can accommodate various sizes of businesses by dividing the system into levels or packages. For example, if the customer purchased a first type package, they would receive customization privileges and 100 access tokens/month, paying a monthly fee to maintain continuous access to the remote field unit's data. Another type of package would be one that provide unlimited access and customization privileges. A low-end package might provide only daily access and no customization privileges.

All of the examples use the following sequence to enter the system site:

1. The customer logs on to a remote access system web site.
2. They can choose from the following selections:

a. WHAT'S NEW (discusses new and/or updates technology issues at Remote access system)

b. PRODUCTS (discusses remote access system products and technology)

c. SERVICES (discusses services provided by remote access system such as virtual instrument panel, equipment installation, engineering consultation, etc...)

d. DATA ACCESS (link to CyberSTAT and CyberVIP: Virtual Instrument Panel).

e. CONTACT US (information about contacting Remote access system by phone, mail, or e-mail)

3. A customer selects DATA ACCESS.

a. Enters User Name, Password and Customer ID.

EXAMPLE I

The following example sets forth a view only generic system, without the incorporation of any specific parameters.

1. A customer purchases the remote access system technology (virtual instrument panel). The remote computer equipment and software is installed in the field. For example, if the system is to monitor and report power outage, the only installation necessary is to plug the unit in and mount the antenna. Through the Internet, they now have access to data from their remote site.

2. CyberSTAT screen is displayed showing customer site, status, last update and error status.

3. The user selects the desired site.

4. CyberVIP presents the virtual instrument panel of the field unit.

5. The user is able to view the report displaying the parameters, current units and the last update date/time log.

EXAMPLE 2

The following generic example illustrates a typical read/write level access.

1. A customer purchases and installs the service provider's hardware and executes an agreement to pay the service provider a monthly fee for system access. An existing corporate computer system, which is assumed to be already connected to the Internet via a local internet service provider, is used as the user's interface to the system. Through the Internet, with proper username, password and customer id, they are now in communication with their remote site.

2. The customer logs on to the remote access system web site.

3. A screen is displayed showing customer site, status, last update and error status.

4. The user selects the desired site.

5. The virtual instrument panel is displayed.

6. The read/write access level, recognized by the system in step 5, enables the user to change the parameters and, if necessary, enter new parameters, to the system.

7. The virtual instrument panel will display two text boxes for each parameter unless the parameter is an sensor output only. A first box for the current value and a box for the new value or desired value. The box for the current value will also show the last date/time updated.

8. A new value may be entered in the new text box. When the update button is selected, the new value is sent to the servlet on the primary site for processing. The servlet sends the data over the communication link network to the controller on the

system. The controller makes the changes to the parameters and sends back verification of the new parameter value over the communication link network. The servlet receives the data, sends it back to the virtual instrument panel, and replaces the data in the "current value" text box for that particular parameter.

EXAMPLE 3

The following illustrates the generic administrative level access.

1. A customer purchases the remote access system technology (virtual instrument panel). The appropriate corporate and remote computer equipment and software is installed on their system. Through the Internet, they are now in communication with their remote site.

2. The customer logs on to a remote access system web site.

4. A screen is displayed showing customer site, status, last update and error status.

5. The user selects the desired site.

6. The virtual instrument panel is displayed.

7. The administration access level, recognized by the system in step 5, enables the user all of the foregoing accesses plus the ability to customize the parameters.

It should be noted that the CyberLogin, Fig 4 can be "hot linked" directly from another web site. This could be the customer's Intranet site or a system's integrator's site. Since the Remote access system servlet technology enables dynamically generated data access HTML pages, the customer is able to use the technology without having to be aware of the technology employed.

EXAMPLE 4

An oil producer has purchased Remote access system technology with administrative privileges to gain access to important data at their well sites.

The following list describes the steps taken by the oil producer in order to access well data:

1. Logs on to the Internet,
2. Select DATA ACCESS from the home page.
3. Based on the Customer ID, User Name and Password entered, a servlet will display a map of the US with highlights on the states where that particular oil producer has wells. The servlet will also generate a pull-down menu listing all of the wells that the oil producer has access to.
4. Select state of interest from the highlighted states by clicking the state of interest.
5. The state map is divided into counties or railroad commissions with the counties containing wells owned by the customer highlighted.
6. The well to be accessed is selected from a list of wells located in that section.
7. The virtual instrument panel for that well will display current parameter values such as max. pump time or well production information along with a last updated date/time stamp.
8. To change a value, enter new value into textbox and select UPDATE.
9. The servlet will receive the new value, send this information through the communication link network to the well site and wait for a response from the controller.
10. The response is received by the servlet, processed and re-displayed on the virtual instrument panel with a new date/time stamp.

EXAMPLE 5

A HVAC equipment manufacturer has purchased Remote access system technology with administrative privileges to gain access to important data where their conveyor systems have been installed.

The HVAC equipment manufacturer will access their data by following the same steps as shown above for the oil producer. The only difference between the two virtual instrument panels would be the titles of the parameters shown. The conveyor producer will customize their virtual instrument panel to display parameters such as motor temperature instead of bore-hole gas pressure.

As can be seen from the foregoing, the disclosed system provides a company with a secure method of monitoring remote sites using the Internet.

Claims

What is claimed is:

1. A monitoring system to enable multiple users to monitor and control remote equipment, said system having:

at least one remote equipment;

a central server, said central server being at a first location and having:

provider software, said provider software having database storage and communication capabilities to store, sort and display data, said provider software being accessible by said user from a second location

at least one servlet, said at least one servlet interfacing between said users and said provider software and preventing said user from directly accessing said provider software,

at least one remote unit, said at least one remote unit being proximate at least one of said remote equipment, each of said at least one remote unit having monitoring means communicating with said remote equipment and communication capabilities to enable said at least one remote unit to have at least one way communication with said provider software,

wherein said at least one remote unit transmits data from said monitoring means to said provider software for storage and display and said user accesses said data through said at least one servlet.

2. The system of claim 1 wherein said users access said data through a computer at said second location.

3. The system of claim 1 wherein said displayed data has at least one level of access, thereby preventing unauthorized users from accessing information.

4. The system of claim 1 wherein said displayed data to be modified has at least one level of access, thereby preventing unauthorized users from accessing and changing information.

5. The system of Claim 3 wherein said access is determined by access codes.

6. The system of claim 1 wherein said displayed data has a read; a read/write and an administrative level, each of said levels respectively increasing access and security to said data.

7. The system of claim 1 wherein said users access said central server over the Internet.

8. The system of claim 1 wherein said remote unit is programmed with definable maximums and minimums for data received from said monitoring means.

9. The system of claim 8 wherein said definable maximums and minimums for data can be redefined by said user.

10. The system of claim 8 wherein said remote unit transmits a message to said provider software that said monitoring means has transmitted data outside the range of said maximums and minimums.

11. The system of claim 1 further comprising a pager, said pager receiving messages from said provider software.

12. The method of claim 1 wherein said remote unit receives said predetermined schedule and automatically reports data based on said predetermined schedule without request from said server.

13. The system of claim 1 wherein said monitoring means are sensors.

14. The system of claim 1 wherein said central server further comprises a web site, said web site having multiple display pages, said display pages displaying said data

transmitted from said remote unit to said provider software and enabling redefinition by said user.

15. The system of claim 1 wherein said data is retrieved for display by said at least one servlet.

16. The system of claim 1 wherein said display format is defined by said user.

17. The system of claim 1 wherein said displayed data is selected by said user.

18. The system of claim 14 wherein at least one of said web pages is a summary page.

19. The system of claim 18 wherein said summary page lists status data for all remote units.

20. The system of claim 14 wherein at least one of said web pages is a detailed data page.

21. The system of claim 20 wherein said detailed data page lists predetermined detailed data for one remote unit.

22. The system of claim 14 wherein at least one of said web pages is an error data page.

23. The system of claim 22 wherein said detailed data page lists predetermined error data for one remote unit.

24. The system of claim 14 wherein at least one of said web pages is a data configuration page.

25. The system of claim 24 wherein said data configuration page enables a user to define parameters for each monitoring device.

26. The system of claim 14 wherein at least one of said web pages is a data setup page.

27. The system of claim 26 wherein said data set up page enables a user to customize data and select from predefine parameters for each monitoring device

28. The system of claim 1 wherein said provider software automatically contacts each of said remote units for each of said users and updates data from each remote unit based on a predetermined schedule.

29. The system of claim 28 wherein said predetermined schedule can be redefined by said user.

30. The system of claim 1 wherein said remote unit receives data from at least two monitoring means and forwards said data for each of said monitoring means to said provider software.

31. The system of claim 1 wherein said user's accesses to said data are tracked by said provider software.

32. The system of claim 1 wherein said user requests said provider software access data on demand from said remote unit.

33. A monitoring system to enable multiple users to monitor and control remote equipment over the Internet, said system having:

a central server, said central server being at a first location and having:

provider software, said provider software having storage and communication capabilities to store and display data, said provider software being accessible by said user through a computer at a second location, said display data being accessed through a web site having multiple pages,

at least one of said web pages being a summary page listing status data for all remote units,

at least one of said web pages being a detailed data page, listing predetermined detailed data for one remote unit,

at least one of said web pages being an error data page listing predetermined error data for one remote unit and

a configuration page, said configuration page enabling defining and redefining of said data definitions of each remote unit,

a plurality of servlets, said plurality of servlets interfacing between said users and said provider software to activate said provider software and tracking data transmission,

access codes, said access codes defining the user ID and access level, wherein said access levels are a read; a read/write and an administrative level, each of said levels respectively increasing access to said data,

at least one remote unit, said at least one remote unit being proximate at least one of said remote equipment, each of said at least one remote unit having at least one monitoring means communicating with said remote equipment and being programmed with definable maximums and minimums for data received from said monitoring means and communication capabilities to enable said at least remote unit to have two way communication with said provider software,

a notification unit, said notification unit being optionally activated by said provider software upon receipt of an error message, said error message including values outside said minimum and maximum values;

wherein said provider software automatically contacts each of said remote units for each of said users and updates data from each remote unit based on a predetermined schedule and said at least one remote transmits data from said monitoring means to

said provider software for storage and display, said user accessing said data through said at least one servlet.

34. The system of claim 33 wherein said user requests said provider software access data from said remote unit.

35. A method of monitoring equipment located at remote locations using a computerized monitoring system having access through the Internet, said system having:

a central server, said central server being at a first location and having:

provider software, said provider software having storage and communication capabilities to store and display data through a web site having multiple display pages, said display pages displaying said data transmitted from said remote unit to said provider software, said provider software having multiple levels of access by a user and being accessible by said user from a second location

at least one servlet, said at least one servlet interfacing between said users and said provider software, each of said at least one servlets saving, retrieving and displaying data from said provider software,

at least one remote unit, said at least one remote unit being proximate at least one of said remote equipment and having monitoring means communicating with said remote equipment and communication capabilities to enable said at least one remote unit to have two way communication with said provider software; each of said at least one remote unit being programmed with definable maximums and minimums for data received from said monitoring means,

comprising the steps of:

a. establishing an account with a user, said account having levels of user ID, one of said levels providing access to define said display of said data;

b. operationally connecting a remote unit at a user's remote site to said remote equipment;

c. accessing said website by said user having access to define said display;

d. defining said display data;

e. setting data parameters from said provider software;

f. setting maximum and minimum values to said data parameters;

g. defining a schedule for said provider software to request data from said remote unit;

h. saving said data parameters, said values and said display data to said provider software;

i. contacting said remote unit by said provider software at user determine scheduled times requesting data;

j. transmitting said data by said remote unit to said provider software;

k. analyzing said received data for values outside user set parameters;

l. checking said user parameters for notification of said user in the event of an error;

m. saving said data in a database for access by said user;

n. accessing said provider software by said user;

o. activating a first servlet

p. entering said user access code;

q. activating a second servlet to enter a summary screen;

r. viewing said summary screen displaying data for each remote unit;

s. activating a third servlet to enter a detailed screen;

t. viewing said detailed screen displaying data for a specific remote unit;

u. checking for errors;

v. activating a third servlet to display an error screen when step u. indicates the existence of an error

wherein said user can define and access data from a remote unit by activating servlets thereby preventing direct access to said provider software.

36. The method of claim 35 wherein said user can redefine said maximum and minimum values to said parameters.

37. The method of claim 35 wherein access to said displayed data has a read; a read/write and an administrative level, each of said levels respectively increasing access to said data.

38. The method of claim 35 wherein said definable maximums and minimums for data can be redefined by said user.

39. The method of claim 35 wherein said remote unit notifies transmits a message to said provider software that said monitoring means has transmitted data outside the range of said maximums and minimums.

40. The method of claim 35 further comprising a pager, said pager receiving messages from said provider software.

41. The method of claim 35 wherein said monitoring means are sensors.

42. The method of claim 35 wherein said data is retrieved for display by said at least one servlet.

43. The method of claim 35 wherein said display format is programmable by said user.

44. The method of claim 35 wherein said displayed data is selected by said user.

45. The method of claim 35 wherein at least one of said web pages is a summary page.

46. The method of claim 45 wherein said summary page lists status data for all remote units.

47. The method of claim 35 wherein at least one of said web pages is a detailed data page.

48. The method of claim 47 wherein said detailed data page lists predetermined detailed data for one remote unit.

49. The method of claim 35 wherein at least one of said web pages is an error data page.

50. The method of claim 47 wherein said detailed data page lists predetermined error data for one remote unit.

51. The method of claim 35 wherein at least one of said web pages is a data configuration page.

52. The method of claim 51 wherein said data configuration page enables a user to define parameters for each monitoring device.

53. The method of claim 35 wherein said provider software automatically contacts each of said remote units for each of said users and updates data from each remote unit based on a predetermined schedule.

54. The method of claim 35 wherein said predetermined schedule can be redefined by said user.

55. The method of claim 35 wherein said remote unit receives data from at least two monitoring means and forwards said data for each of said monitoring means to said provider software.

56. The method of claim 35 wherein said remote unit receives said predetermined schedule and automatically reports data based on said predetermined schedule without request from said server.

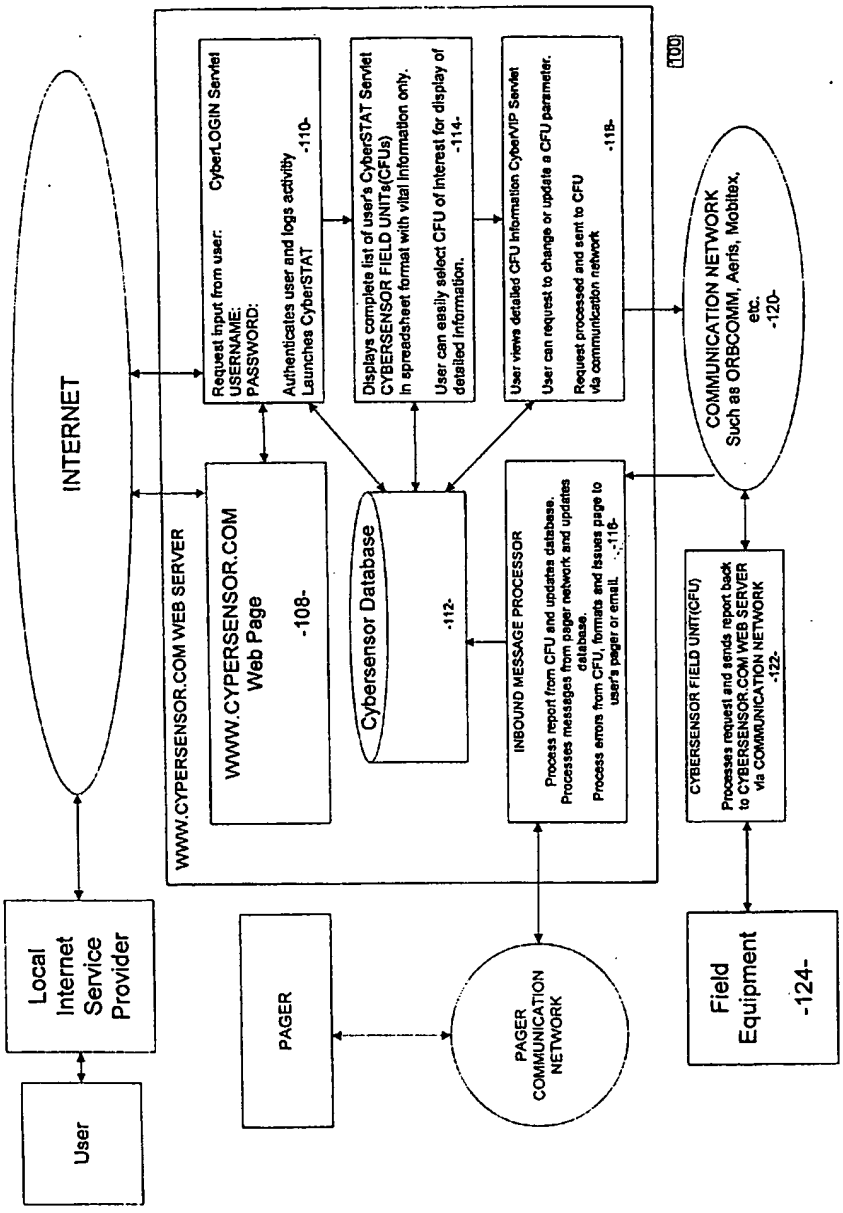

INTERNET
WWW.CYPERSENSOR.COM WEB SERVER
Request input from user: CyberLOGIN Servlet
USERNAME:
PASSWORD:
Authenticates user and logs activity
Launches CyberSTAT
-110-
Displays complete list of user's CyberSTAT Servlet
CYBERSENSOR FIELD UNITs(CFUs)
In spreadsheet format with vital information only.
User can easily select CFU of interest for display of detailed information.
-114-
User views detailed CFU information CyberVIP Servlet
User can request to change or update a CFU parameter.
Request processed and sent to CFU
via communication network
-118-
100
WWW.CYPERSENSOR.COM
Web Page
-108-
Cybersensor Database
-112-
INBOUND MESSAGE PROCESSOR
Process report from CFU and updates database.
Processes messages from pager network and updates database.
Process errors from CFU, formats and issues page to user's pager or email.
-116-
COMMUNICATION NETWORK
Such as ORBCOMM, Aerls, Mobitex, etc.
-120-
CYBERSENSOR FIELD UNIT(CFU)
Processes request and sends report back to CYBERSENSOR.COM WEB SERVER via COMMUNICATION NETWORK
-122-
Local Internet Service Provider
User
PAGER
PAGER COMMUNICATION NETWORK
Field Equipment
-124-

Figure 1

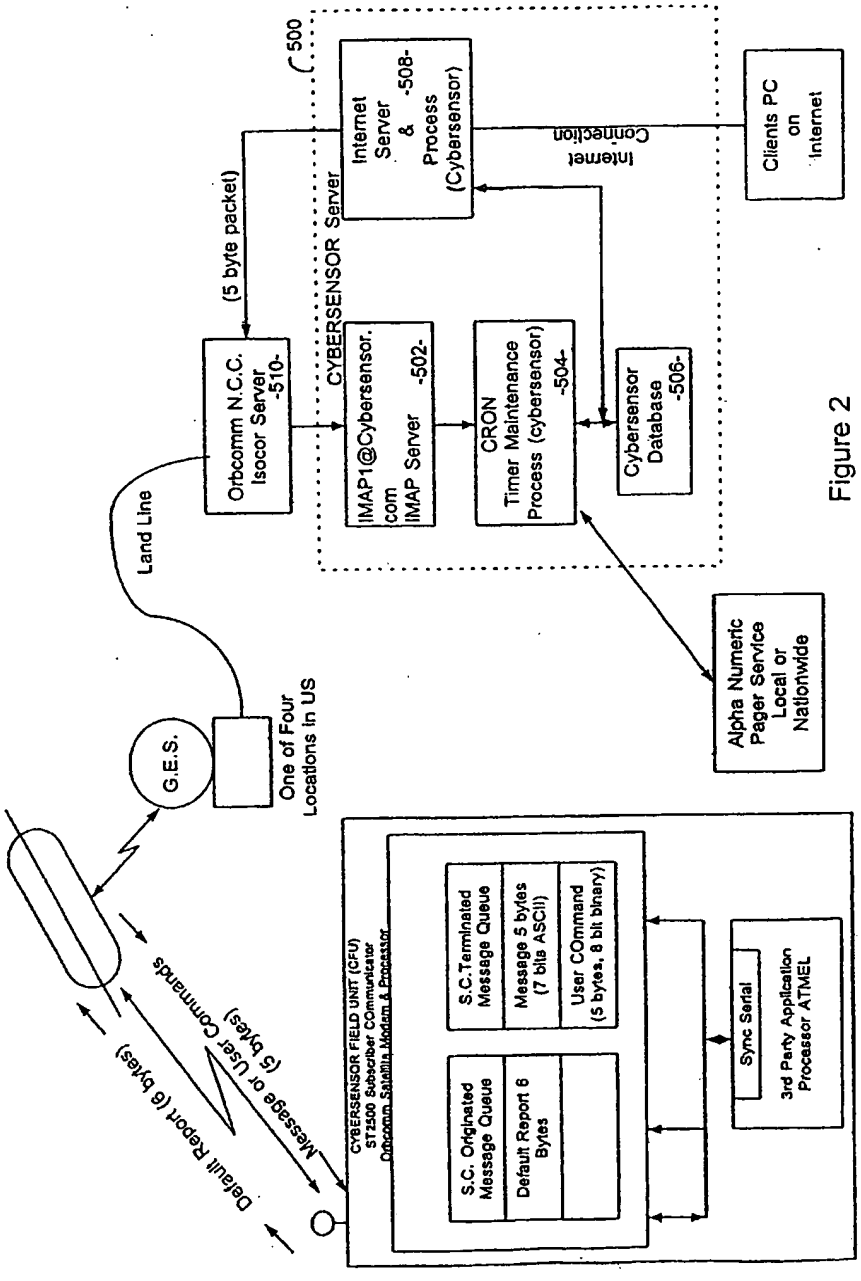

500
CYBERSENSOR Server
Internet Server & Process (Cybersensor) -508-
Clients PC on Internet
Internet Connection
(5 byte packet)
Orbcomm N.C.C. Isocor Server -510-
IMAP1@Cybersensor.com IMAP Server -502-
CRON Timer Maintenance Process (cybersensor) -504-
Cybersensor Database -506-
Land Line
Alpha Numeric Pager Service Local or Nationwide
G.E.S.
One of Four Locations in US
Default Report (6 bytes)
Message or User Commands (5 bytes)
CYBERSENSOR FIELD UNIT (CFU)
ST2500 Subscriber COmmunicator
Orbcomm Satellite Modem & Processor
S.C. Originated Message Queue
Default Report 6 Bytes
S.C.Terminated Message Queue
Message 5 bytes (7 bits ASCII)
User COmmand (5 bytes, 8 bit binary)
Sync Serial
3rd Party Application Processor ATMEL

Figure 2

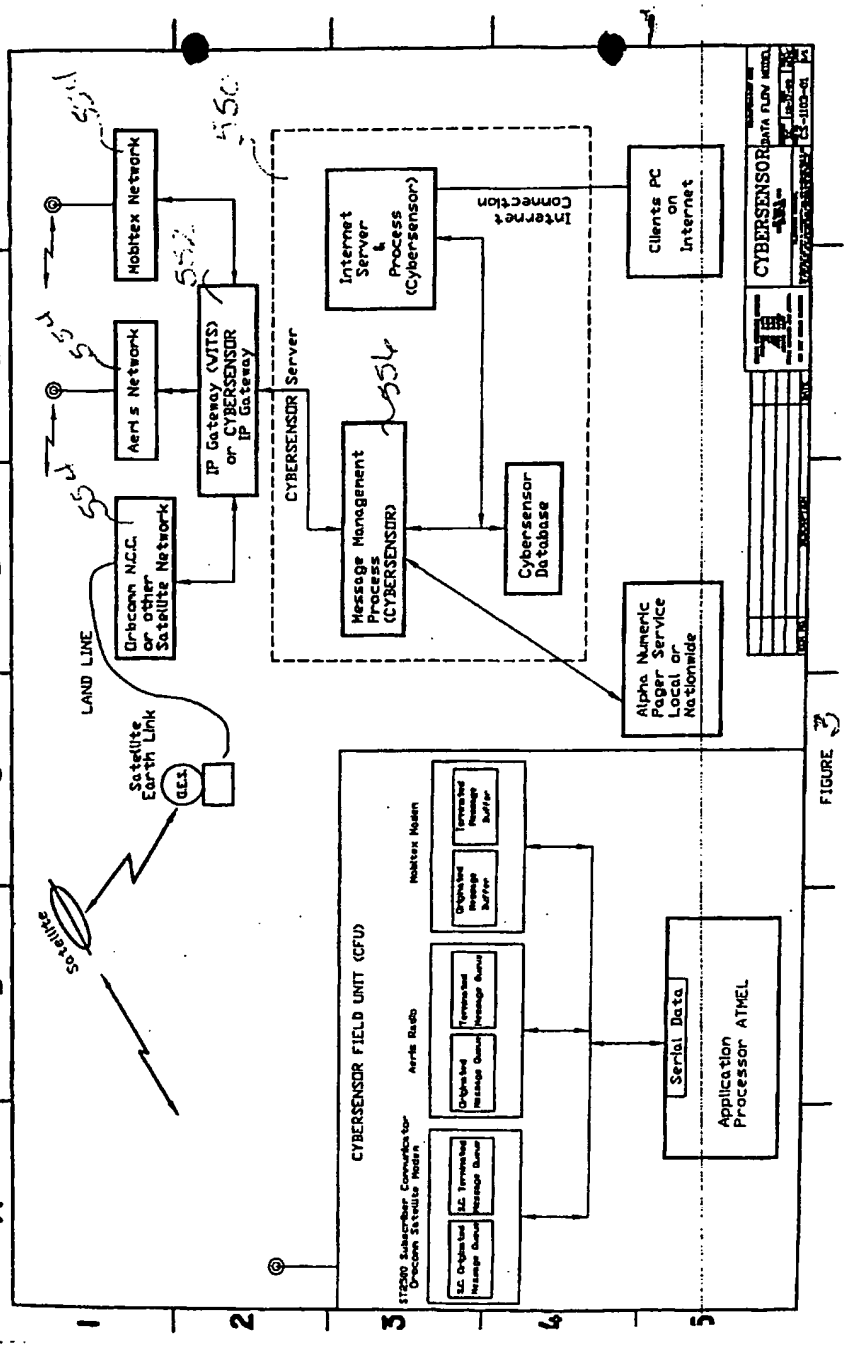
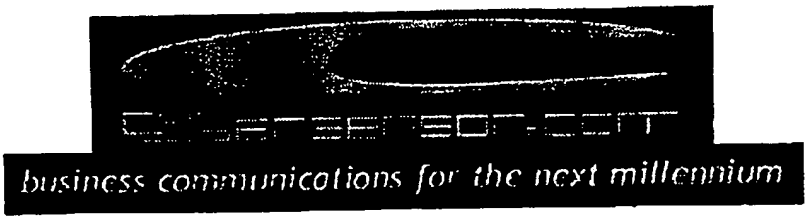
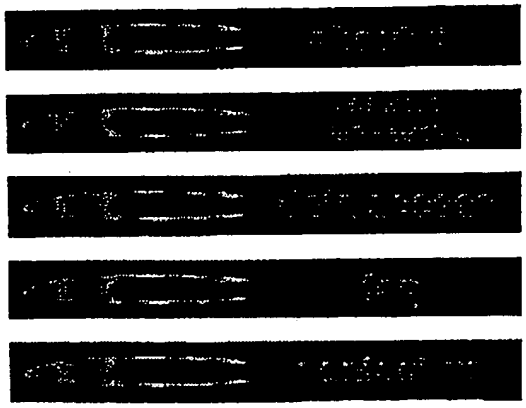

Mobitex Network
Aeris Network
Orbcomm N.C.C. or other Satellite Network
IP Gateway (VITS) or CYBERSENSOR IP Gateway
CYBERSENSOR Server
Internet Server & Process (Cybersensor)
Internet Connection
Clients PC on Internet
Message Management Process (CYBERSENSOR)
Cybersensor Database
Alpha Numeric Pager Service Local or Nationwide
LAND LINE
Satellite Earth Link
G.E.S.
Satellite
CYBERSENSOR FIELD UNIT (CFU)
Mobitex Modem
Aeris Radio
Originated Message Buffer
Terminated Message Buffer
Originated Message Queue
Terminated Message Queue
Serial Data
Application Processor ATMEL
CYBERSENSOR
A
B
C
D
E
F
1
2
3
4
5

FIGURE 3





ABOUT US CORPORATE INFORMATION DATA ACCESS FAQ CONTACT US

ORBCOMM

Fig 4

Welcome!!! Please enter your username and password to log into CyberVIP.

Username: parker.AD 50

Password: 52

Customer id: cyber01 54

Log In

ABOUT US CORPORATE INFORMATION DATA ACCESS FAQ CONTACT US

ORBCOMM

Fig 5

↑
110

CyberSTAT

For Cybersensor Monitoring

UNIT NAME	STATUS	LAST RECEIVED REPORT	ERROR STATUS	STATS GRAPH
Butler County PPS1	No New Reports	4/5/00 6:25:58 AM PDT	clear	---
Well #3976	No New Reports	4/5/00 6:51:52 AM PDT	clear	---
FloraPJC1	No New Reports	3/31/00 8:00:07 AM PST	ack	---
WELL 72-41-SX-10	No New Reports	4/5/00 6:26:17 AM PDT	clear	---
Well #3044	No New Reports	4/5/00 4:27:10 PM PDT	clear	---
WELL 72-2-SX-10	No New Reports	4/5/00 6:32:25 AM PDT	clear	---
BC well #10	No New Reports	new	clear	---
Nu-Metrics Test Unit	No New Reports	2/25/00 1:45:44 PM PST	clear	---
V-2838	No New Reports	4/5/00 12:32:33 PM PDT	clear	---
KP 1160	No New Reports	4/5/00 12:25:58 PM PDT	clear	---
VC-3007	No New Reports	4/6/00 9:19:52 AM PDT	error	---

118 Fig 7

CyberVIP

For Field Unit: Butler County PPS1

Access Tokens Remaining: 79

CyberSTAT

Send Log Files

ERROR STATUS

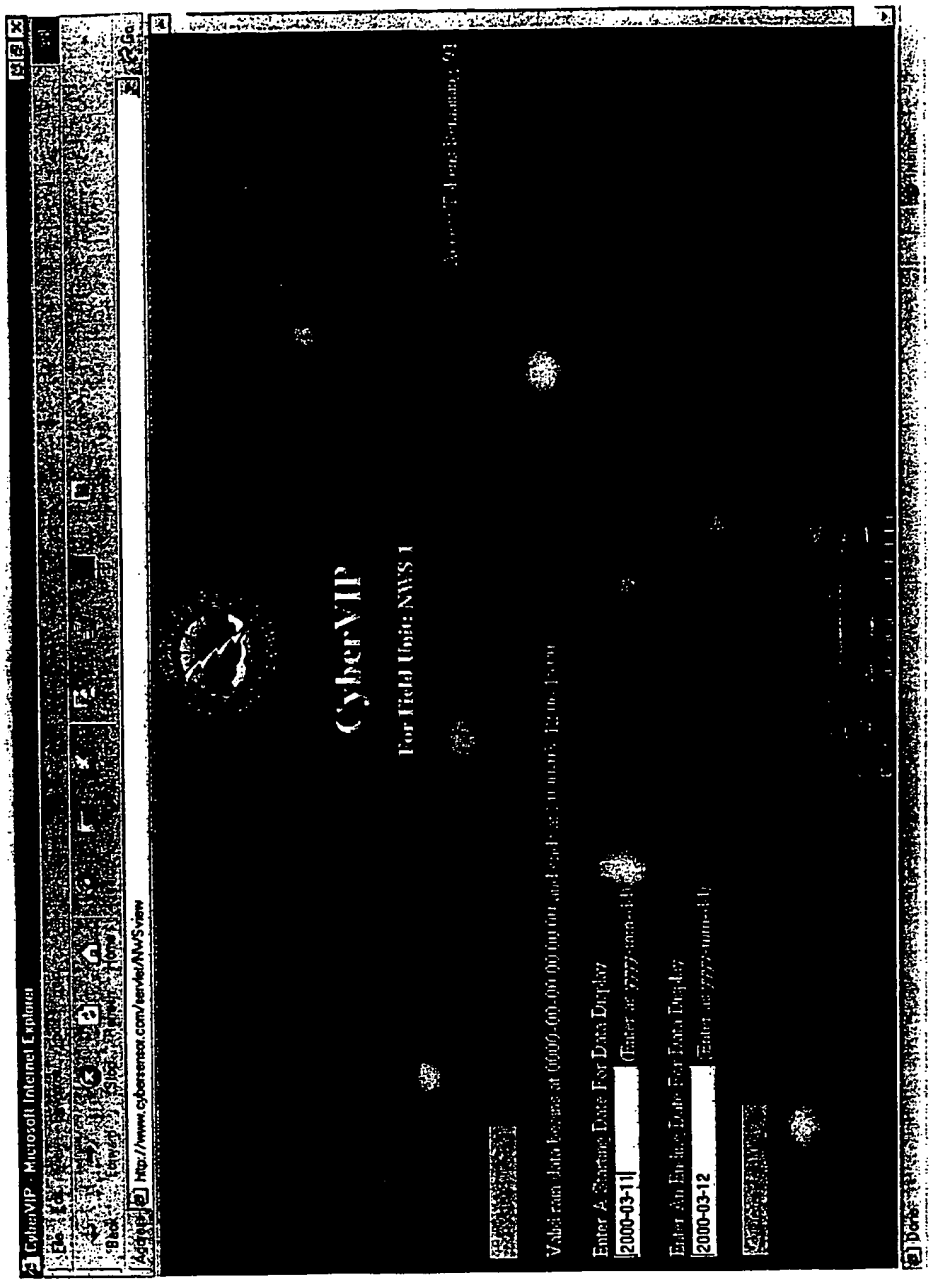
DESCRIPTION	LAST UPDATED
System OK	00

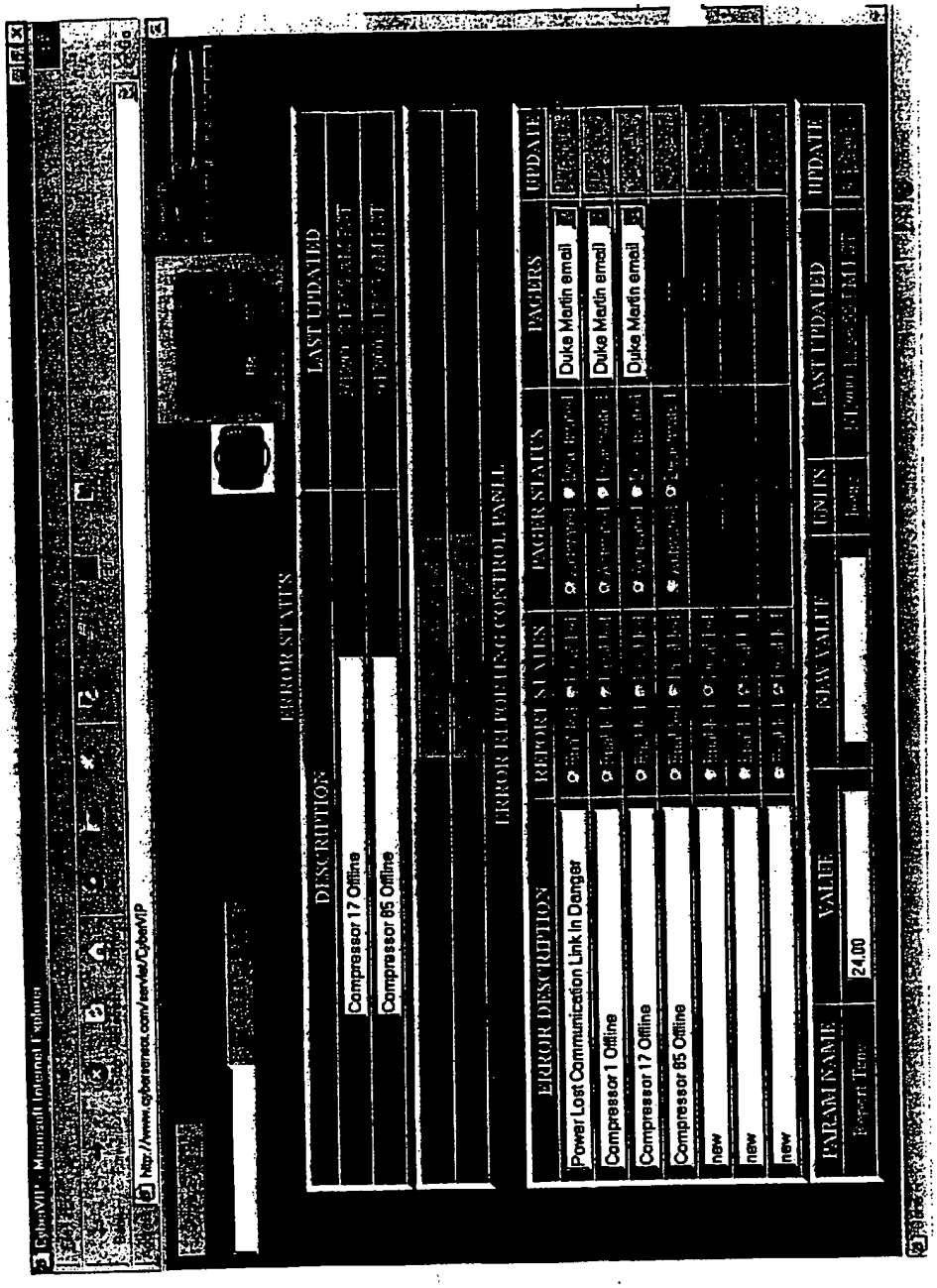
Request Error Status

ERROR REPORTING CONTROL PANEL

ERROR DESCRIPTION	REPORT STATUS	PAGER STATUS	PAGERS	UPDATE

PARAM NAME	VALUE	NEW VALUE	UNITS	LAST UPDATED	UPDATE
Outlet Pressure	248.68	----------	psig	4/5/00 6:24:48 AM PDT	Update
Liquid Level Sensor	15.80	----------	volts	4/5/00 6:24:48 AM PDT	Update
Compressor Pressure	7.35	----------	psig	4/5/00 6:24:48 AM PDT	Update
Inlet Pressure	497.35	----------	psig	4/5/00 6:24:48 AM PDT	Update


CyberVIP - Microsoft Internet Explorer
Address
http://www.cybersense.com/servlet/AVSview
CyberVIP
For Field Unit: NWS 1
Enter A Starting Date For Data Display
2000-03-11
Enter An Ending Date For Data Display
2000-03-12


CyberVIP - Microsoft Internet Explorer
http://www.cyberviewnet.com/servlet/CyberVIP
ERROR STATUS
DESCRIPTION
LAST UPDATED
Compressor 17 Offline
Compressor 85 Offline
ERROR REPORTING CONTROL PANEL
ERROR DESCRIPTION
REPORT STATUS
PAGER STATUS
PAGERS
UPDATE
Power Lost Communication Link In Danger
Compressor 1 Offline
Compressor 17 Offline
Compressor 85 Offline
new
new
new
Duke Martin email
PARAM NAME
VALUE
RAW VALUE
UNITS
LAST UPDATED
Report Time
24.00

CyberGRAPH
PC-7 Compression
Compressor 2
Compressor 1
AC Power
12/26/99 12:00 AM
1/5/00 12:00 AM
1/15/00 12:00 AM
1/25/00 12:00 AM
2/4/00 12:00 AM
2/14/00 12:00 AM
2/24/00 12:00 AM
3/5/00 12:00 AM

FIG. 12

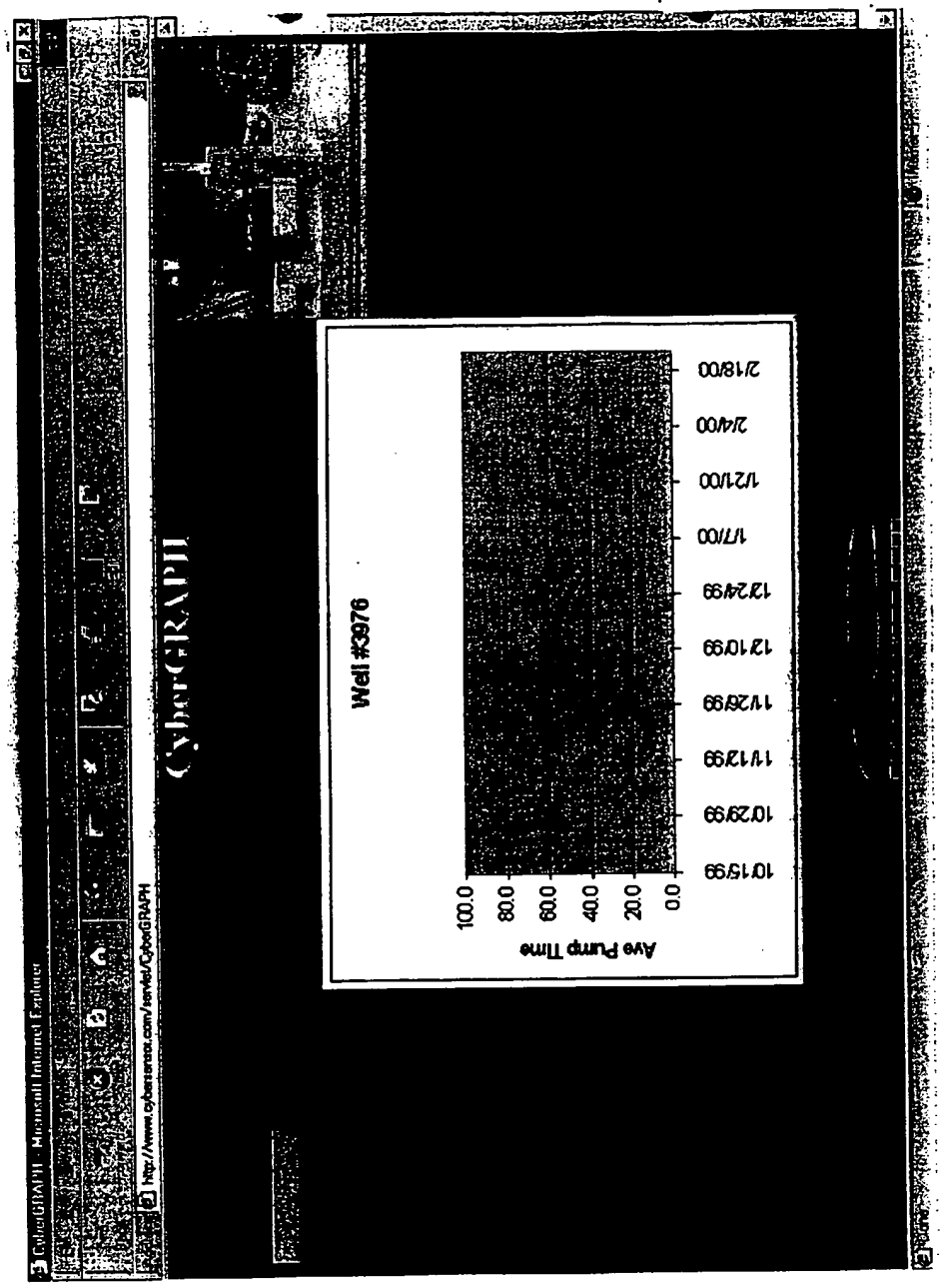
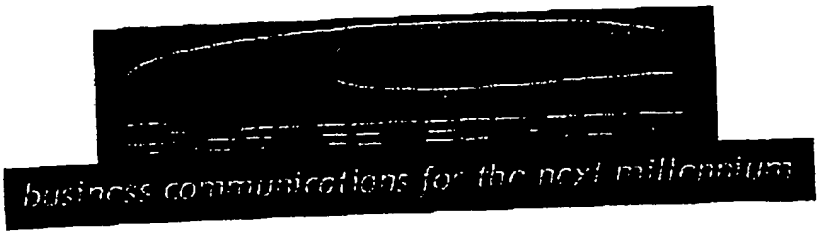

CyberGRAPH
Well #3976
Ave Pump Time
100.0
80.0
60.0
40.0
20.0
0.0
10/15/99
10/29/99
11/12/99
11/26/99
12/10/99
12/24/99
1/7/00
1/21/00
2/4/00
2/18/00

Fig 6



Unit Configuration Form

Error Definitions

Error Definiton	New Error Definition
Compressor 1 Offline	
Compressor 2 Offline	
Compressor 3 Offline	
Compressor 4 Offline	
Compressor 5 Offline	

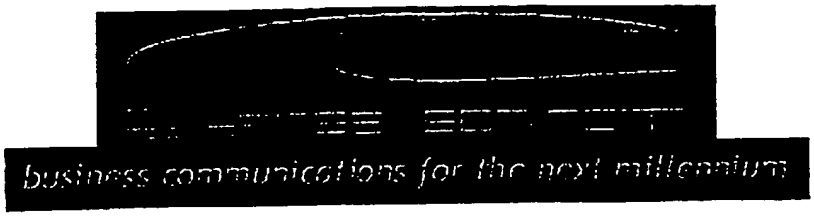
Data Definitions

Parameter Name	Units	New Parameter Name	Sensor	New Sensor
Report Time	hours		none	none
Enable\Disable Error Reports	units		none	none

Device Definitions

Current Unit Name	New Unit Name
Tim Test Unit	

Fig 12



ACCOUNT SETUP

Enter ORBCOMM Surname:	
Enter Desired Unitname:	
Enter Unit Serial Number:	
Enter Customer ID:	
Enter Date:	
Select Account Action:	C Add C Delete
Pager Service:	C Yes C No
Select User Application:	Pump Jack Controller

Fig 13

INTERNATIONAL SEARCH REPORT

Inter .onal application No.
PCT/US00/09227

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G05B 15/02
US CL : 700/9,2,241,244

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 700/9,2,241,244,96,19

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,805,442 A (CRATER et al.) 08 September 1998 (08.09.1998), Figures 1-2, column 2 lines 56-67, column 3 lines 1-20, column 6 lines 59-68	1-56
Y,P	US 6,038,486 A (SAITOH et al.) 14 March 2000 (14.03.2000), Figures 1, 2, and 4-10, column 2 l ines 38-67, column 4 lines 47-64, column 5 lines 3-10	1-56
Y,E	US 6,061,603 A (PAPADOPOULOS et al.) 09 May 2000 (09.05.2000), Figures 1-3, column 3 lines 52-55, column 4 lines 15-25, column 10 lines 1-19	1-56
Y,P	US 5,928,323 A (GOSLING et al.) 27 July 1999 (27.07.1999), Figures 1-3, column 2 lines 6-18	1, 15, 33, 35, 42
Y,P	US 5,895,457 A (KUROWSKI et al.) 20 April 1999 (20.04.1999), column 7 lines 40-46	11, 40
A	US 6,049,775 A (GERTNER et al.) 11 April 2000 (11.04.2000), All	
A	US 5,980,090 A (ROYAL, JR. et al.) 09 November 1999 (09.11.1999), All	

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 June 2000 (20.06.2000)	15 AUG 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C 20231 Facsimile No. (703)305-3230	Authorized officer Edward Gain James R. Matthews Telephone No. 703 305 7335

Form PCT/ISA/210 (second sheet) (July 1998)